National Climatic Data Center

DATA DOCUMENTATION

FOR

DATA SET 6411 (DSI-6411)

Soil Moisture for Western Russia and The Ukraine

December 12, 2002

National Climatic Data Center
151 Patton Ave.
Asheville, NC 28801-5001 USA

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1. Abstract: This archive is comprised of soil moisture data and the accompanying information for the agricultural regions of Western Russia (west of ~ 60E) and The Ukraine for the period from 1992 to 1996. This data are collected routinely for agro-meteorological monitoring of these two countries and serve as an input for the in-situ assessment of the state of the major crops. ***Plant available soil moisture*** in the upper first meter (for several layers) is a key element of this monitoring and is collected in the near-real time with a 10-day time step. This information cannot be assessed properly without extensive metadata that characterize the soil type and agro physical properties of the upper first meter of the soil at each field. These metadata are defined once per 10-15 years, are rarely reassessed and thus named *soil constants*.

Soil moisture measurements are made during the warm period of the year. In the cold season, an essential part of the agro-meteorological monitoring is the information about snow depth at the agricultural fields. This information (only for Russia) is also included in this archive.

Agro-meteorological stations of the former Soviet Union have an elaborate observational program that fits the needs of crop monitoring. Soil moisture content is measured by gravimetric methods during the warm season, specific for each crop. The results of this monitoring are prepared 3 times per month (on the 8th, 18th, 28th of each month). The regular observations are made from the beginning of the field work (as a rule in April) until harvest time. About 70-80 % of all soil moisture observations in Russia are made in the European part of the country. However, this depends on the specific crops. For example, almost all fields of winter crops are situated in the European territory and there are only 20% of the total spring wheat fields there.

An English-language detailed description of the gravimetric method can be found in Vinnikov and Eserkepova (1991) and Robock et al. (1995). These measurements are made at depths of 0-5 cm, 0-10 cm, 0-20 cm, 0-50 cm, 0-100 cm (0-10 cm, 0-20 cm, and 0-50 cm for potatoes). In The Ukraine, measurements for two layers (0-20 cm and 0-100 cm) are made most regularly. These undergo a laborious manual quality control and are used in regionally averaged characteristics of the state of the crops. If a station is used for monitoring a given crop, each soil moisture measurement is an average of measurements at four points of the same agricultural field with this crop.

Soil type, field capacity, volumetric density, and wilting level are periodically evaluated (or on file) for most of these fields. It is important to mention here, when the field is spatially inhomogeneous, several cross-sections are made to secure this information. All Ukrainian stations and approximately 70% of Russian agro-meteorological stations, have these hydrological constants on file. Snow depth and density is monitored through the agro-meteorological network. This information is also included as accompanying information to the data set.

While the gravimetric method allows us to measure total water content of the soil level, the agronomists are actually interested in *plant available soil moisture*. Therefore, for each field a soil constant "*non-productive soil moisture*" is subtracted from soil moisture measurements and the data of agro-monitoring are provided in the units of the *plant available soil moisture.* The non-productive soil moisture at each field is defined as soil moisture at the wilting level and is included or can be derived from the soil constants available in this archive.

Crop types in Russia and The Ukraine with soil moisture data available in this archive

Table 1 summarizes the soil moisture information that is available for four major crops over Russia (maize, winter wheat, summer wheat, and barley) for the period 1992 to 1996.

Table 1. Data on soil moisture measurements for Russia for the period 1992 to 1996

Crop	Number of stations Total	In western Russia only	Period of observation
maize	150 - 200	112	spring-summer
spring wheat	230 - 280	28	spring-summer
winter wheat	150 - 200	157	spring-summer-fall
spring barley	180 - 230	110	spring-summer

Note: For winter wheat in autumn the observations are made in new fields.

The same type of information for The Ukraine is summarized in Table 2.

Table 2. Data on soil moisture measurements for The Ukraine for two layers (0-20 cm, and 0-100 cm)

Crop	Number of stations	Period of observation
Maize	70	April-September
Spring wheat	70	April-July
Winter wheat	71	spring-summer-fall

Note: Starting in 1992, the Ukrainian meteorological service has discontinued the fall observations of soil moisture for winter wheat at the layer 0-100 cm.

The period of crop soil moisture observations depends on the weather situation during the vegetation season (initial spring conditions and the speed of plant development). It may differ significantly (from start and finish) from year to year. As usual, in autumn, the winter wheat soil moisture observations continue in the new field at the same station. The timetable of the soil moisture observations in Russia and the Ukraine is given in Table 3.

Table 3. The timetable of the soil moisture observations.

Season	Winter WHEAT	OTHER CROPS
Autumn	after harvesting the preceding crop until late autumn	NO
Spring and Summer	after renewals of vegetation until max maturity	after start of spring works until max maturity

The format of the records in the soil moisture data set was specially designed to fit into any database. Due to significant differences in the content of the information Russian and Ukrainian data sets have different formats as described below. Each record starts with the crop type code. The following codes were selected to assign major crops:

1 - maize
2 - spring wheat
3 - winter wheat
4 – barley (available only for the Russian Federation)

2. Element Names and Definitions:

Ukrainian plant-available soil moisture data are organized into 3 files, one file per crop.

The file names are **UKR_CROP.1, UKR_CROP.2** and **UKR_CROP.3** for maize, spring wheat, and winter wheat accordingly (and files of the stations' coordinates and names are in the files **UKRCROP1.LST** through **UKRCROP3.LST**). The files with soil moisture data contain information for 1992 through 1996. The data for winter wheat started in autumn 1991 to cover the entire agricultural cycle with this crop. Observations from two major surface layers (from the surface to 20 cm and from the surface to 1 m) are presented in this data set. Measurements (if any) at other layers were used only for quality control purposes and are absent in the files. This gives the user somewhat trouble-free collection of the soil moisture measurements.

Each file for a given year contains 140 to 142 records for soil moisture data (2 records per station; 140 for maize and spring wheat and 142 for winter wheat). Commas separate the fields in the record. These fields are:

1. Crop code (1 for maize, 2 for spring wheat, etc.)
2. Year
3. Station name (the data are sorted in this field alphabetically)
4. WMO station number
5. Layer, for which soil moisture data are presented in the record:
   020 indicates the surface to 20 cm layer and
   100 indicates the surface to 100 cm layer.

The next two fields repeat several times to show the entire year of soil moisture observations at the agro-meteorological station. The period of these observations can be different for different stations and different years!

6. The date of observation is in FORTRAN format (i2,i2); the first two digits indicate the month and second two digits the ending date of the decade. So, 0520 indicates the second decade of May.
7. Soil moisture estimate (mm) in the decade is given in data-field 6 for the layer from data field 5. Missing values are coded 999.

Example: 1, 1993, POCHTOVOE, 33945, 020, 0410, 33, 0420, 999, 0430, 999, 0510,

1 - crop type (maize); 1993 - year of observations; Pochtovoe - station name; 33945 - WMO index, 020 (100) - layer from 0 to 20 cm, or from 0 to 100 cm; 0410 - date: I.e., 04 indicates the month and 10 indicates the

date of the decade end; this date means that the observation was made at the end of the first decade of April (on 8 April); 33 - soil moisture value in mm, 999 - missing value code.

The Russian plant-available soil moisture data set differs significantly from the Ukrainian data. It contains **all** data that arrive operationally to the Russian Hydrometeorological Center and are used for agro-meteorological monitoring and forecast. Therefore, for some layers at some stations we see much more absent/unobserved data substituted by missing codes than in the Ukrainian data set. But, instead of a refined subset (as in the Ukrainian data set) we assemble a much richer data set from all agro-meteorological stations of the Russian Federation to the west of the Ural Mountains with all soil moisture measurements available up to 5 layers of the first upper meter. This information is accompanied by five (for wheat and barley) or six (maize) characteristics of the crop status and by representative information about snow depth and density around the station. The network is changing slightly with time: the fields are switched to different crops; some stations have been closed during the past five years, a few new stations have been established/transferred from other locations. This is an essential process with each network. Taking into account the importance of the agro-meteorological monitoring, this network is being preserved in good condition by the Russian hydrometeorological service.

Due to communication problems, some operational information from remote locations in Russia did not reach the regional meteorological office in time to participate in the monitoring. In this case it was lost and was not included in the data set. This situation never occurred with the Ukrainian data, where the missing data always means that no observation has been made.

Digital operational data for two 10-day intervals in 1992 were completely lost (the tapes were scratched). Therefore, there are no soil moisture data available in Russia for the third decade of April and for the third decade of August in 1992. The August 1992 failure to collect data affected only winter wheat and maize. The April 1992 failure affected all crops in the southern part of Russia.

Five years of soil moisture monitoring over European Russia are in the files: **RUS_CROP.1** through **RUS_CROP.4** and files of the stations' coordinates and names are in the files **RUSCROP1.LST** through **RUSCROP4.LST**. The structure of the files **RUS_CROP.1** to **RUS_CROP.4** is as follows. The data are presented in the "map" format, all stations per given date. Their names now placed separately in the files with extension .lst

The names of the fields in files **RUS_CROP.1** to **RUS_CROP.4** are:

I.	Crop code
II.	Year
III.	Date
IV.	"WMO" station number (for stations with WMO number starting with "5", this number is not a valid WMO number but internal code)
V.	Code for estimation of plants condition (see Table 4 below)
VI.	Code for the weed conditions (see Table 5 below)
VII.	Plant height (cm) at the last day of decade
VIII.	Plants density (number/m^2)
IX.	[FOR MAIZE ONLY!!!] average weight of plant (gram)

X. Soil water content (mm of water layer) in 1 m layer
XI. Soil water content (mm of water layer) in 0 to 50 cm layer
XII. Soil water content (mm of water layer) in 0 to 20 cm layer
XIII. Soil water content (mm of water layer) in 0 to 10 cm layer
XIV. Soil water contents (mm of water layer) in 0 to 5 cm layer

Absent information is replaced by 999. Dividers (commas) are always used.

Example:

```
.....................
2,1993,0530,34289, 3, 1, 22, 999, 110, 57, 24, 11, 999
2,1993,0530,34352, 999, 999, 999, 999, 107, 49, 16, 6, 2
...................
```

In the example above, part of the "**RUS_CROP.2**" file is presented with the data for the third decade of May 1993. At the station with the WMO# 34289 plant (spring wheat) and weed conditions are provided. The average plant height is 22 cm. No plant density information is available. Soil water contents of the four layers from 1 m to 10 cm are provided but in the upper 5 cm the measurement is absent. For the station with the WMO# 34352, there is no information about plant conditions but complete soil moisture information is reported for all five layers.

Absent information is replaced by 999. Dividers (commas) are always used.

Table 4.
Codes of subjective estimation of plant conditions.

Estimation	Code
Excellent	5
Good	4
Satisfactory	3
Bad	2
Very bad	1
Mortification	0

Table 5.
Codes of quantity of weeds.

Estimation	Code
No weeds	0
Very rare	1
Rare	2
Often	3
Very often	4

For the Ukraine, file **SOIL.UKR** presents soil constants for three levels (0 to 10 cm, 0 to 20 cm, and 0 to 1m) for each field. There is no missing information in these constants because this is a preselected set of the best stations. In one case, at station Pochtovoe, soil measurements for level 0 to 1 m are absent because below the depth of 50 cm the soil itself is absent (rocks). Instead, a layer 0 to 50 cm is provided. A time dependent set (two measurements for each station) is supplied for each of the Ukrainian constants which are, time by time, re-evaluated at the stations. Therefore, we provide the constants derived during the previous "cycle" of measurements at the same field with indication of the year when they were derived. The data fields in the file are always separated by commas.

The data structure of this file by field is:

1. Crop type: e.g., 3 - winter wheat

2. Year when the constants were evaluated at the field (the last year or previous to the last year)
3. WMO station code
4. Layer: values 10, 20, or 100 characterize the layers 0-10 cm, 0-20 cm, and 0-100 cm respectively
5. Then four fields with the values of soil constants are presented:
   1) Volumetric soil density (g cm^{-3})
   2) Wilting level (% of absolute dry soil)
   3) Field capacity, (mm of plant available water)
   4) Porosity (mm of plant available water)
6. Station name (last field).

The order of stations is random.

The file **NPSM.UKR** contains non-productive soil moisture data for the last date when it was defined (coordinated with the second date in the file **SOIL.UKR**).

The data structure of this file by field is:

1. Crop type: e.g., 1-maize; 2-spring wheat; 3 - winter wheat
2. The last year when the constants were evaluated at the field
3. WMO station code
4. Layer: values 10, 20, or 100 characterize the layers 0-10 cm, 0-20 cm, and 0-100 cm respectively
5. Non-productive soil moisture (mm)
6. Station name (last field).

The order of stations is random.

Soil type for Ukrainian stations are presented in the files with the station names and coordinates (files **UKRCROP?.LST**).

For Russia, in file **SOIL.RUS** we made a concise effort to collect the data from *all* agro-stations to the west of 60 E and for *all* layers with a 10 cm resolution in the first meter of soil. We were able to collect data for 209 stations from the initial list of 230 agro-meteorological stations and add to this list the soil constants of three more agro-stations for which we also provide soil moisture information. Generally, the Russian soil moisture data set contains more stations than in the file SOIL.RUS and more stations than in the initial list of 230 stations which we planned to collect. But, for these residual agro-stations our metadata provides only coordinates that also make them a valuable source of supplementary information on soil moisture. The fields in the file are separated by commas.

The data structure of this file by field is:

1. WMO station code
2. Layer: values 10, 20, 30, ...100 characterize the layers 0-10 cm, 10-20 cm, 20-30, ...90 cm-100 cm respectively. **Please note** a significant difference in the layer definition with the Ukrainian data set.
3. Then six fields with the values of soil constants are presented:
   1) Volumetric soil density (g cm^{-3})
   2) Maximum hygroscopic level (% of volumetric soil density)
   3) Wilting level (% of volumetric soil density)
   4) Field capacity, (% of volumetric soil density)

:

5) Capillary water capacity (% of volumetric soil density)
6) Porosity (% of volumetric soil density)

4. Soil type
5. Station name (last field).

The stations are sorted by WMO number. Please note that the WMO station numbers that start with 5 are not official WMO numbers but internal identification numbers of these stations. Missing values are coded 99.0 or 99.00. At Annenkovo (WMO number 57210) the VSD information was not provided for the two lowest layers (90 to 100 cm and 80 to 90 cm), while the soil constant, field capacity, has been somehow estimated and is present in the file.

Archive of snow cover depth and density data from the agro-meteorological network of the CIS has the following structure:

I.	Year
II.	Date,
III.	WMO station number
IV.	Snow depth (cm) at the last day of decade
V.	Code of snow spread
VI.	Snow density (x100) in g cm^{-3}. For example, 25 indicates 0.25 g cm^{-3}.

Generally, these snow cover data should represent agricultural regions of European Russia only, but it appears that the Ukraine, Belarus, Moldova, and southern Siberia have also been covered (at least for the part of period). There are no snow data available for the second decade of January in 1993 and for the second decade of February and December in 1992. The file names are: **RUS_SNOW.DAT** for the data and **RUS_SNOW.LST** for the stations' coordinates.

Table 6. Codes of snow cover spread used in the archive

****

0 - no snow (the stations with this code are not included in the data set)
1 - 70-80% of area is without snow cover due to wind blowing
2 - 40-60% of area is without snow cover due to wind blowing
3 - Some places are free of snow cover (less than 30% or area) due to wind blowing
4 - 100% of area under even snow cover
5 - 100% of area under uneven snow cover
6 - Some places are free of snow due to melting
7 - 50% of area is free of snow cover due to spring melting
8 - 75% of area is free of snow cover due to spring melting
9 - Snow cover in some places only (less than 10% of area)

Soil moisture throughout this archive always means ***plant available soil moisture***. It is derived from total amount of water in a given layer measured at the site by subtracting the ***non-productive soil moisture*** (the soil moisture at wilting level) that is a constant for a given field and layer.

The metadata files include station coordinates, files **UKR.LST** and **RUS.LST**, and baseline soil characteristics files of the fields where the soil moisture measurements have been conducted: files **SOIL.RUS**, **SOIL.UKR** and **NPSM.UKR**. These characteristics are:

:
:

I. Soil type
II. Volumetric density
III. Wilting level
IV. Field Capacity
V. Porosity

Additionally, for Russia, two more soil characteristics have been provided:

I. Maximum hygroscopic level
II. Capillary capacity.

For The Ukraine, non-productive soil moisture for the most recent period of its estimation is separated in a special file **NPSM.UKR**. The layers and total file structure for these soil characteristics for Russia and The Ukraine are different and are described below after a brief definition of the soil constants in our list.

Soil type information does not require additional definition. It has been taken from the station passports. For the Ukraine, additional efforts were made to define the soil type for those fields that were used for a given crop during the past five years and the information for a previous soil constants evaluation at ***the same field*** was also documented. Generally, the Ukrainian agro-meteorologists have a "one-center" control of the information from their agro-stations, while in European Russia this information is collected and stored at nine Regional Centers that are difficult to reach for additional explanations/comments. Therefore, for each Russian agro-meteorological station we present the most commonly met soil constants and soil type defined at the station experimental fields. The rationale for such approach is that the crops at each field often change from year to year and, without exact information about each field used in a given year, the over-specification makes no sense.

Volumetric soil density, VSD, is a major soil characteristic. It is defined as the ratio of dry soil mass to total volume of the undisturbed structure and is measured in g cm^{-3}. The volumetric density is measured by cutting a known volume of the soil, drying, and weighing it. Then the volumetric density is defined as the ratio of the weight to a preselected volume. In western literature "**dry bulk density**" is a synonym of **VSD**. This differs from a ***soil density*** that is defined by mulching the soil, drying, weighing, and estimating the volume of the sample. Then the bulk density is estimated as the ratio of the weight to this volume. ***VSD*** is estimated at each agro-station, except for those layers that have no soil (only rocks).

Maximum hygroscopic level, MHL, is defined as maximum amount of water that soil can absorb from saturated air (with relative humidity above 94%). This water is stored in the soil by surface-absorption forces and is not available to plants. The ***MHL*** is defined in laboratory conditions.

The same is true with the ***wilting level, WL***. Its evaluation is an arduous procedure, when the plant (often oats) is placed in the soil that is initially well saturated but then the water supply is shut down. When the plant shows clear signs of mortification, the soil is weighed, then dried and weighed again. The water that was found in the soil sample (in mm or in % of volumetric density) defines ***WL***. Sometimes a simple method is used to define ***WL***:

WL = K x **MHL**, where K is a regional coefficient between 1 and 2. Quite often K

is close to 4/3.

WL is organically related to *non-productive soil moisture (**NPSM)***, that is defined for each *10 cm layer* (and sometimes for upper 5 cm) as

NPSM (mm) = ***WL***(%)*VSD(g cm^{-3}) * (layer depth in cm) *10 /100

For other layers it is defined by arithmetic averaging. Russian soil moisture constants are provided with a 10 cm layer resolution and, therefore, ***NPSM*** for each layer can be recalculated from ***WL***. This archive provides Ukrainian soil moisture constants only for three layers, 10, 20, and 100 cm and ***NPSM*** cannot be derived from ***WL*** for each layer. Therefore, an additional file **NPSM.UKR** with this variable is provided in the archive.

Field capacity, FC, is defined in field conditions. A large portion of undisturbed soil in the field is well saturated and then sealed from the atmosphere. A portion of water drains and the residual (when the equilibrium is established) provides the estimate of ***FC***. It can be measured in mm of plant available water or in % of the ***VSD.***

In the regions where the water table is close to the surface, estimation of field capacity is difficult and is substituted by estimation of the ***Capillary water capacity, CWC***. This is a little higher than field capacity and is defined as a maximum amount of water to be held above the water table. To define this quantity a 10 cm soil sample is taken from the field to a laboratory where it is placed on a net with water below it. Thus, free access to the "water table" is secured. After a balance is established, the water in the soil is measured and this is the "Capillary water capacity".

In the former USSR, ***porosity, POR,*** is also called "total water capacity". It is supposed that all soil pores can be filled with water and this justifies the porosity measurements in mm of water. Due to specific requirements of agro-monitoring, total water capacity is often presented in mm of plant available water by subtracting the ***NPSM*** from ***POR***. Another way to present porosity data is to provide it in percent of the ***VSD.***

If field capacity, wilting level, maximum hygroscopic level, or porosity are provided in percents, then their product with the volumetric weight and the level height will deliver the measurement in cm or mm of water. Here the instructions to field observers "heavily" use the following property of water: the weight of 1 cm^3 is 1 g.

To convert ***FC*** and ***POR*** in mm of plant available water from % of ***VSD*** following formulae are employed:

FC(mm) = [FC(%)-WL(%)]*VSD* (layer depth in cm) *10 /100

POR(mm) = [POR(%)-WL(%)]*VSD* (layer depth in cm) *10 /100.

3. Start Date: 19910801

4. Stop Date: 19961231

5. Coverage: Europe and Asia

a. Southernmost Latitude: 40N
b. Northernmost Latitude: 65N
c. Westernmost Longitude: 20E
d. Easternmost Longitude: 65E

6. How to Order Data:

Ask NCDC's Climate Services about the cost of obtaining this data set.
Phone: 828-271-4800
FAX: 828-271-4876
E-mail: NCDC.Orders@noaa.gov

7. Archiving Data Center:

National Climatic Data Center
Federal Building
151 Patton Avenue
Asheville, NC 28801-5001
Phone: (828) 271-4800.

8. Technical Contact:

National Climatic Data Center
Federal Building
151 Patton Avenue
Asheville, NC 28801-5001
Phone: (828) 271-4800.

9. Known Uncorrected Problems:

(a) Some snow cover and soil moisture data from the stations of the former Soviet Union beyond the major coverage area have been included in the part of Russian soil moisture and snow cover data sets.

(b) In the Ukrainian metadata we have to include an additional file with non-productive soil moisture, **NPSM.UKR**, in mm for the last period when this variable was defined. The attempt to calculate this variable directly from the WL given in percent (in file **SOIL.UKR**) will not give coincided results because the ***WL*** (%) information for the composite layers (0-20 cm, and 0-100 cm) was totaled arithmetically and in the cases when ***NPSM*** changes with depth non-linearly this makes its values non-deductible from ***WL***. Below we summarized the list of fields and layers in the Ukraine where the two estimates of NPSM (properly averaged and calculated from the layer-averaged ***WL*** and ***VSD***) differ more than by 10%.

Crop Code	***WMO*** #	Year	Layer from 0 cm to	Non-productive soil moisture in mm **NPSM.UKR** calculated from ***WL*** in **SOIL.UKR**	
1	33877	1970	100	172.0	149.5
1	33869	1981	100	85.0	70.0
1	33261	1976	100	65.0	54.6
1	33382	1986	100	91.0	81.9

1	33356	1975	100	89.0	74.8
1	33339	1973	100	76.0	67.2
1	33605	1975	100	103.0	87.1
1	34523	1981	100	188.0	160.8
1	33088	1982	20	5.0	4.5
2	33415	1983	20	19.0	17.0
2	33409	1988	100	146.0	128.8
2	33536	1992	100	122.0	106.6
2	33312	1972	100	62.0	36.0
2	33135	1990	100	55.0	45.0
2	33049	1984	20	5.0	4.5
2	33246	1990	100	111.0	95.2
2	33382	1992	100	91.0	78.0
2	33356	1971	100	87.0	74.8
2	33605	1975	100	100.0	87.1
2	33484	1975	20	17.0	14.8
2	34509	1992	100	151.0	134.2
2	33088	1992	20	6.0	5.1
2	33088	1992	100	31.0	24.0
3	33299	1988	100	55.0	46.2
3	33777	1995	100	76.0	61.5
3	33288	1991	20	18.0	16.1
3	33135	1992	100	53.0	41.6
3	33246	1991	100	71.0	62.4
3	33049	1991	100	56.0	33.6
3	33146	1992	100	65.0	46.4
3	33261	1991	100	64.0	46.8
3	33466	1992	100	114.0	99.0
3	33439	1989	100	104.0	91.0
3	33581	1991	100	131.0	110.4
3	33605	1991	100	106.0	88.4
3	34615	1988	100	194.0	174.0
3	34421	1980	100	171.0	153.4
3	33495	1992	100	131.0	115.0
3	33296	1992	100	85.0	64.9

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10. **Quality Statement**: Quality control of the Russian soil moisture and snow cover data was as follows:

The misprints were deleted. The large outliers were identified, re-checked, and, if necessary, deleted.

Several logical conditions were checked (the layer 0-5 cm could not contain more water than the 0-10 cm layer, etc.) and the revealed inconsistencies were deleted.

The stations where the snow depth (cm) data (averaged for several measurements near the meteorological station) was equal to zero or the snow cover depth observations were not performed (in the case when snow covers less than 60% of visual station vicinity) were deleted. This has to be kept in mind by the users of these data. The data are well suited for plotting the snow depth/density over the Russian agricultural land area (well represented by the station list) but may create a false impression that beyond this area, say, to the north of the area covered by the agro-meteorological network or in the neighboring republics of the former Soviet Union, there is no snow on the ground.

The Ukrainian soil moisture data set was quality controlled visually 100% by proof reading two-times with the original observational records. Additionally, these data have passed a rigorous logical control by an experienced hydrologist. These data represent the information from a subset of the Ukrainian agro-meteorological network. In this subset the best stations with the most complete data records and most experienced observers were selected.

11. Essential Companion Datasets:

12. References: No information provided with original documentation.

a. Vinnikov, K.Ya. and I.B. Eserkepova, 1991: Soil moisture: Empirical data and model results. J. Climate, 4, 66-79.

b. Robock, A., K.Ya. Vinnikov, C.A. Schlosser, N.A. Speranskaya, and Y. Xue,1995: Use of midlatitude soil moisture and meteorological observations to validate soil moisture simulations with biosphere and bucket models. J. Climate, 8, 15-35.